Performance of Capacitors Using Organic Electrolytes

Manabu Tsushima, Yong Che and Takeshi Morimoto
Research Center, Asahi Glass Co. Ltd.,
1150 Hazawa-cho, Kanagawa-ku, Yokohama-shi,
Kanagawa, 221-8755 Japan
e-mail: tsushima@agc.co.jp

Introduction

Electric double-layer capacitor (EDLC) using activated carbon electrodes and organic electrolytes has been developed, and is widely used as maintenance-free power source for IC memories and microcomputers (1,2).

A new promising application for EDLC is a pulse power source in fuel-cell and hybrid electric vehicles. EDLC has longer cycle life and higher power density compared with batteries, because the faradaic reaction is not involved in the charge and discharge process. However, its energy density is smaller than that of batteries. Since the energy of the capacitors is proportional to the square of the cell voltage, enhancement of the cell voltage is an effective way to increase the energy density.

To obtain a capacitor having high working voltage, a new hybrid capacitor consisting of activated carbon cathode, carbon anode that can dope lithium ion and organic electrolytes is investigated.

Experimental

The cells used were coin-type ones. They were assembled at dew point of less than –60 ^{o}C. Cathode and anode materials were activated carbon having BET surface area of 2000 m^2/g and graphitic carbon whose average particle diameter is 20 micrometers, respectively. The organic electrolytes containing lithium salt were used. The moisture of electrolytes was less than 20 ppm.

Results and Discussion

Fig.1 compares the discharge curves of the hybrid capacitor and EDLC at a constant current of 0.5 mA/cm^2. The hybrid capacitor and EDLC were discharged from 4.3 V to 2.75 V and from 2.8 V to 1.0 V, respectively. The capacitance of the hybrid capacitor is larger than that of EDLC at this current density. However, as shown in Fig.2, the capacitance of the hybrid capacitor becomes almost the same as that of EDLC at the higher current density of 10 mA/cm^2. This is because internal resistance of the hybrid capacitor is higher than that of EDLC.

References

1. T. Morimoto, K. Hiratsuka, Y. Sanada, K. Kurihara, S. Ohkubo and Y. Kimura, Proceedings of the 33rd International Power Sources Symposium, 618 (1988).
2. T. Morimoto, M. Tsushima and Y. Che, Mat. Res. Soc. Symp. Proc., **575**, 357 (2000) .

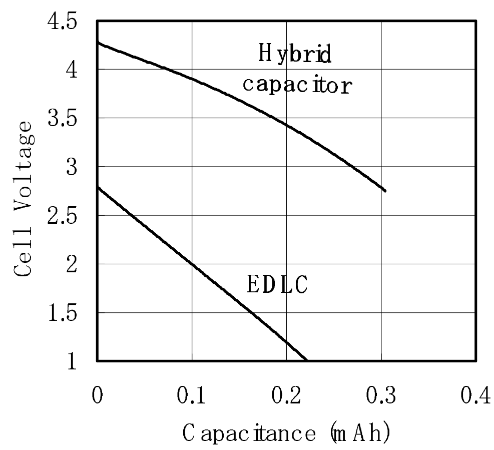

Fig.1 Discharge curves of the hybrid capacitor and EDLC.

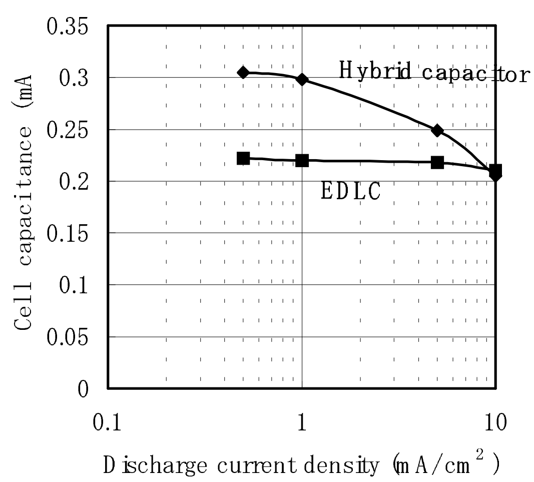

Fig.2 Cell capacitance of the hybrid capacitor and EDLC at various discharge current density.